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### NATIONAL WEATHER SERVICE INSTRUCTION 10-506

Operations and Services Public Weather Services, NWSPD 10-5

### DIGITAL DATA PRODUCTS/SERVICES SPECIFICATION

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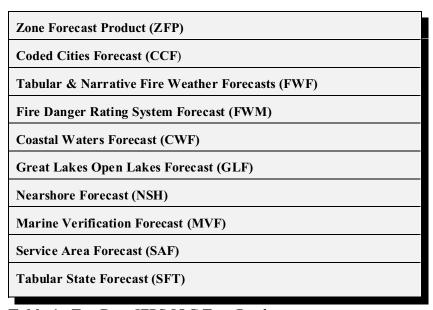
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# **Digital Data Products/Services Specification**

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- 1. <u>Introduction</u>. This procedural instruction provides specifications and guidelines for products and services resulting from the digital forecast database prepared by the National Weather Service. This document also describes the basic digital data infrastructure including the National Digital Forecast Database (NDFD), locally prepared digital forecast databases, and associated NWS coordination/collaboration to enable the production of a seamless suite of digital forecast data.
- 2. <u>Mission Connection.</u> NDFD is a means to utilize digital technology to the fullest, and make a seamless suite of NWS information available efficiently, and in a convenient and understandable form to best meet customer and partner needs. In support of the mission described in the *National Weather Service Strategic Plan*, the NDFD is a "...national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community."
- 3. <u>Preparation of the local Digital Forecast Databases</u>. Forecasters at each Weather Forecast Office (WFO) will use the Interactive Forecast Preparation System (IFPS) software on the Automated Weather Interactive Proposition System (AWI) of toprepare digital forecast databases for their geographic area of responsibility. NWS products digital, text, and graphic) will be automatically formatted from these local atabases using A VIPS software.
- 3.1 WFO Initial Operating Capability (IOC) Grid Production. The minimum threshold for IFPS/NDFD IOC grid production throughout the contempinous United States includes the generation of all grid fields necessary to support the production of the 10 text-based products listed in Table 1. Refer to Appendix A for specific definitions and minimum thresholds for temporal and spatial resolution of the elements necessary to produce these 10 text products. See Table 3, Appendix B for a matrix display of the grids required for each of the 10 text products.



**Table 1.** Ten Base IFPS IOC Text Products.

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**Exception:** The Tabular and Narrative Fire Weather Forecasts (FWF) and the Fire Danger Rating System Forecast (FWM) in Table 1 may be composed manually until text formatters are fully mature, as long as the minimum required grid elements are created to produce these products in digitally derived formats.

- 3.2 <u>Local Digital Forecast Database Update Criteria</u>. Local grids should be updated when the on-duty forecast team believes the forecast is not representative of current or expected weather conditions. Reaching or exceeding collaboration thresholds (shown in Appendix A) may be used as a guide to initiate updates for particular gridded fields. Well-coordinated local or regional update thresholds may be developed until standardized national update criteria are established.
- 3.3 <u>Priority of Local Grids during Active Hazardous Weather</u>. The first priority of every WFO is to sustain office warning operations to protect life and property. Should the forecasting or updating of routine gridded fields preclude these efforts during active hazardous weather, the affected WFO should coordinate a transfer of local digital database maintenance to their assigned service backup office. See NWSI 10-2201 for specific service backup requirements.
- 3.4 <u>Local Grid Upload to Central Server</u>. Digital forecast information from local databases will be uploaded to a central server (i.e., NDFD) and mosaiced into regional and national grids. The NDFD is a single source of weather forecast information for customers who desire large scale products; it will also include links to WFO servers for smaller scale needs.
- 3.5 <u>Local Grid Dissemination.</u> Digital forecast information from local digital databases will be displayed graphically on WFO web sites in standardized formats. WFOs may use other means of disseminating digital data to meet local customer needs.
- 4. <u>Intersite Coordination/Collaboration</u>. The NWS goal is to provide customers and partners with a seamless set of digital forecast weather fields for the entire nation. To attain this goal, local offices and national centers should collaborate to achieve meteorological consistency among the various weather elements and along office boundaries. As a result, "ownership" of the NDFD will be <u>shared</u> among all local offices and national centers involved in the collaborative process.

This section contains roles, responsibilities, and guidelines for textual, audio, and video exchange of meteorological information among offices and national centers for effective gridded forecast decision making. In addition, effective collaborative sessions can facilitate exchange of scientific information throughout the meteorological community. Forecasters are expected to use initiative and professional judgment in conjunction with these guidelines and convey this information through meteorological discussions.

- 4.1 Operational Collaboration Responsibilities.
- 4.1.1 <u>National Centers for Environmental Prediction (NCEP)</u>. The Hydrometeorological Prediction Center (HPC) will collaborate with WFOs to facilitate agreement among neighboring

offices' forecast grids on the evolution of weather systems and the associated sensible weather. Collaboration will involve the conterminous U.S. beginning at 12 hours into the forecast cycle and extending out through seven days.

The Storm Prediction Center (SPC) collaborates with WFOs concerning both science and service needed to create optimal NWS products concerning mesoscale weather hazards and in particular severe convective storms, thunderstorms, and fire weather. Focused collaboration between the SPC and WFOs will occur prior to the issuance of convective watches. The Tropical Prediction Center (TPC), SPC, and WFOs will coordinate/collaborate on SPC's issuance of tornado watches associated with hurricanes and tropical storms.

TPC collaborates with WFOs and some U.S. Naval bases for tropical weather in the North Atlantic, Caribbean, Gulf of Mexico, and eastern North Pacific east of 140W longitude, including the development, movement, and intensification of tropical storms and hurricanes. TPC also coordinates/collaborates with coastal forecast offices and HPC before the issuance of hurricane and tropical storm watches and warnings. TPC, the Ocean Prediction Center (OPC), and/or WFO Honolulu will coordinate/collaborate as necessary when issuing high seas forecasts for their neighboring areas of responsibilities.

- a. The Aviation Weather Center (AWC), the Alaskan Aviation Weather Unit (AAWU), WFO Honolulu, and WFO Guam will coordinate/collaborate as necessary when issuing SIGMETs for their neighboring aviation areas of responsibilities.
- b. TPC and WFO Honolulu will coordinate/collaborate as necessary when issuing tropical cyclone forecasts/advisories for their neighboring areas of responsibilities.
- 4.1.2 Weather Forecast Offices (WFOs). Each WFO coordinates/collaborates on factors affecting their forecast area of responsibility. WFOs coordinate/collaborate with adjacent WFOs and National Centers. WFOs will collaborate among neighboring offices to ensure consistency on spatial and timing issues affecting their geographic area of responsibility. WFOs will exchange preliminary Intersite Coordination (ISC) grids to minimize discontinuities before the grids are released to customers. Additionally, WFOs will coordinate/collaborate on regional and national scales (i.e., with NCEP) as required by the size and scope of the event being addressed. Tools, including chat rooms, voice communication, and exchange of AWIPS graphics will support the collaboration and coordination effort (see Section 4.2).
- 4.1.3 <u>River Forecast Centers (RFCs)</u>. RFC coordination and collaboration will occur with those weather elements which impact hydrologic modeling (e.g., temperature, quantitative precipitation forecasts {QPF}, snow accumulation, freezing levels). RFCs will coordinate/collaborate with the HPC and WFOs regarding these elements when necessary. RFCs have access to tools, including chat rooms, voice communication, and exchange of products over AWIPS.

4.2 <u>Collaboration Technology</u>. The NWS will use standardized software for the purpose of collaboration. Technical information and procedures for using the most recent software are described in detail by clicking on the following active web link below:

#### **Collaboration Tool Tutorial**

4.3 <u>Collaboration Windows</u>. Collaboration may be triggered by various weather and non-weather related events (e.g., receipt of new observational data, forecast discontinuities, extreme weather events, surrounding office issues, etc.). However, new model data is the most regular driver of changes to the database. To facilitate effective collaboration, recommended collaboration windows have been established based on the scheduled receipt of new model data (see Figure 1). It is important to note that unforeseen events can always necessitate collaboration outside of these windows. Therefore, the collaboration tool should remain open at each office at all times.

```
04 UTC - 06 UTC - predominately short range (days 1 - 3)
12 UTC - 15 UTC - predominately long range (days 4 - 7)
16 UTC - 18 UTC - predominately short range (days 1 - 3)
22 UTC - 24 UTC - possible window for short range based on 18Z runs
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Figure 1. Recommended Collaboration Windows in Coordinated Universal Time (UTC).

- 4.4 <u>Collaboration Thresholds</u>. WFOs should adhere to a standard set of collaboration thresholds to ensure a coherent and high quality National Digital Forecast Database. These thresholds were developed for all NWS forecast offices. Refer to Appendix A for the standardized collaboration thresholds for the various weather elements.
- 5. National Digital Forecast Database (NDFD) Description.
- 5.1 <u>Definition</u>. The National Digital Forecast Database (NDFD) is a central database storing geospatially referenced digital forecast information. The NDFD houses both *official* and *experimental* grid fields (as defined in <u>NWSI 10-102</u>, <u>New or Enhanced Products and Services</u>) from many operational elements of the NWS. Forecasts produced at individual WFOs are mosaiced into national and regional products, forming national and regional grids. The NDFD is the primary means by which grids will be made available to customers and partners.
- 5.2 <u>NDFD Preparation</u>. The implementation of digital forecast preparation capability at WFOs is necessary to create a National Digital Forecast Database. The Interactive Forecast Process (IFP) represents a substantial change for forecasters. Instead of manually typing a myriad of forecast products, forecasters rely on interactive model interpretation and editing techniques to prepare gridded forecasts of weather elements in a common digital database from which forecast products will be automatically composed, formatted and transmitted. The common digital database used to generate these products will allow for more consistent forecasts over time and

among products, and for easier monitoring and maintenance of those forecasts. NDFD provides a foundation for the development of a new generation of grid-based NWS products, including the forecast digital database itself.

- 5.3 <u>NDFD Contents</u>. The NDFD will contain digital forecasts of official weather, water, and climate forecast information generated at WFOs and NCEP. NDFD will provide baseline elements that primarily serve national and regional users. In addition, NDFD will include digital watch, warning, and advisory information, and other elements that attract the private development of graphics and decision tools.
- NDFD Consistency. The NDFD will include forecasts prepared at NCEP service centers and forecast offices nationwide. It will be a "mosaic" in the sense that the grids from individual WFOs and NCEP will appear together on a master grid; therefore, the contents of the NDFD must be consistent in time and space to be of greatest benefit to NWS customers and partners. In addition, the base digital data and other representations of the data should have an interface with a standardized look and feel for ease of use and understanding.

WFOs are responsible for the accuracy, timeliness and meteorological consistency of forecast data as established in <u>Policy Directive 10-5</u>, <u>Public Weather Services</u>. NDFD grid fields should be meteorologically continuous from hour to hour and from grid point to grid point, especially along County Warning and Forecast Area (CWFA) boundaries. To minimize county CWFA boundary discontinuities, WFOs should follow existing collaboration guidelines and thresholds. Additionally, NDFD software is capable of recognizing significant discontinuities and of notifying the respective WFOs of potential problems.

#### 6. Digital Forecast Products Specification.

- Base Digital Forecast Data. Base digital data is available in NDFD for a variety of official and experimental grid fields originally generated at WFOs and NCEP. The status of these grid fields will be clearly indicated within the file. The specific grids (and associated resolutions) available in the NDFD are shown in Appendix C-NDFD Weather Element Tables. Data will be periodically added to this database based on internal and external requirements. Files will eventually contain forecast data for several public, winter weather, severe weather, fire weather, marine, aviation, hydrologic, and climatic elements for time projections out to a maximum of 168 hours from 00 UTC Day 1.
- 6.1.1 <u>Purpose</u>. Advances in computer capabilities and web services technologies, as well as scientific advances in NWS software, have prompted the NWS to create products and services to meet new customer and partner requirements. The NDFD base digital data will allow the NWS to provide near-real time, collaborated forecasts that are widely accessible in digital formats. Customers and partners can transform the NWS digital data into a wide range of text, graphic, and image products and services.

- 6.1.2 <u>Audience</u>. Base digital data is primarily provided for large volume users of forecast information, but also for anyone interested in using software to explore various means to manipulate and utilize digital forecast information.
- 6.1.3 <u>Availability and Timeliness</u>. The NDFD is a dynamic forecast database. Forecast grids are generated and revised at the local WFOs and NCEP on an event-driven basis. The revised digital data is transferred to the NDFD server and made available shortly after the top of each hour. At a minimum, the base digital data is renewed daily around 1800 UTC to extend the forecast database by 24 hours.
- 6.1.4 <u>Format</u>. A primary means for providing forecasts from the NDFD is through File Transfer Protocol (FTP) in <u>GRIB</u>, <u>Edition 2</u>, <u>format</u>. Initially, these grids will contain surface areal dimensions (i.e., length, width) plus time. The grids will have sufficient temporal and spatial detail to support automatic product formatters.
- 6.1.5 <u>Spatial Resolution</u>. Spatial resolution of the NDFD grids will be 5 kilometers (km) for the conterminous United States, and as appropriate for locations outside the conterminous United States.
- 6.1.6 <u>Temporal Resolution</u>. The temporal resolution of forecast elements varies, but is generally 3 hours through 72 hours, and 6 hours beyond 72 hours out to a maximum of 168 hours from 00 UTC Day 1 (see Appendix C NDFD Weather Element Tables).
- 6.1.7 NDFD Gridded Data Access. NDFD forecast data can be obtained for the entire conterminous United States, or for 1 of 16 CONUS overlapping geographic sectors and Puerto Rico. See Figure 2 for a general depiction of sector locations. Click on the active web link below to access an interactive map clearly depicting the boundaries of the NDFD data sectors.

NDFD Geographic Sectors Coverage

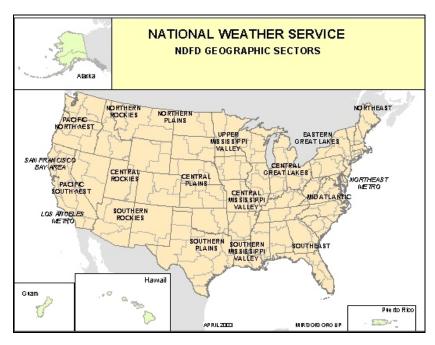


Figure 2. NDFD Geographic Sectors Map.

Sectors will also become available for Alaska, Hawaii, Guam, and other areas of the Pacific Region. The data can be accessed from the NDFD FTP server by following the instructions provided via the active web link below:

#### NDFD GRIB2 Data Access

#### 7. NDFD Graphic Forecast Displays Specification.

- National and Regional Forecast Mosaics. The National Weather Service's NDFD mosaic products are a collage of a prescribed set of data contained within the NDFD. These images are the graphic representations of the official NWS digital forecast. The mosaics are created on national and regional scales and will follow a standardized format prescribed by the NWS to best meet the needs of its customers and partners. The data originate from the WFO local databases and are uploaded to the NDFD server where the mosaic is created. The official mosaiced graphic images display weather parameters for a defined temporal and spatial resolution out to a maximum time projection of 168 hours from issuance (7 days).
- 7.1.1 <u>Purpose</u>. NDFD Graphic Forecast Displays are a means to utilize technology to the fullest, and make a seamless suite of NWS information available efficiently, and in a convenient and understandable form to best meet customer and partner needs. The NDFD graphic forecasts fulfill NWS objectives for improving the accessibility and availability of weather information by posting NWS products and data on the Internet in graphic-oriented formats.

- 7.1.2 <u>Audience</u>. NDFD graphic mosaics satisfy a wide range of customers and partners including the general public, emergency managers, private sector and the media.
- 7.1.3 <u>Availability and Timeliness</u>. The NDFD web-based graphic mosaics are continuously available on the NDFD web page. Forecast grids are revised at the local WFOs on an event-driven basis. The revised grids are uploaded to the NDFD server and new graphic mosaics are generated shortly after the top of each hour. At a minimum, revised mosaics will be refreshed daily around 1800 UTC.
- 7.1.4 <u>Graphic Mosaic Content</u>. The NDFD graphic mosaics will contain a combination of clearly labeled *official and experimental* grid fields (as defined in <u>NWSI 10-102</u>, <u>New or Enhanced Products and Services</u>) in a nationally standardized format. The specific grids (and associated resolutions) available in the NDFD are shown in Appendix C-NDFD Weather Element Tables. Data will be periodically added to the displays based on internal and external requirements. Graphic displays of NDFD will eventually contain forecast data for several public, winter weather, severe weather, fire weather, marine, aviation, hydrologic, and climatic elements for time projections out to a maximum of 168 hours from 00 UTC Day 1 issuance.
- 7.1.5 <u>Presentation Format</u>. The NDFD graphic mosaic provides weather forecast information for the conterminous United States, while the NDFD regional mosaics provide images for 16 slightly overlapping geographic sectors throughout the conterminous United States. Additionally, geographic data sectors are available for Puerto Rico. Locations outside the conterminous United States including, Alaska, Hawaii, and Guam will also become available in the future. To serve users with requirements for high density population centers, graphic displays for various major metropolitan areas, e.g., San Francisco Bay Area, Los Angeles Metro, and Northeast Metro have been provided (see Figure 2).
- 7.1.6 <u>Spatial Resolution</u>. NDFD graphic mosaics will be displayed at a grid resolution of 5 km for the conterminous United States, and as appropriate for locations outside the conterminous United States.
- 7.1.7 <u>Temporal Resolution</u>. The temporal resolution of forecast elements varies, but is generally 3 hours through 72 hours, and 6 hours beyond 72 hours out to a maximum of 168 hours from 00 UTC Day 1 (see Appendix C NDFD Weather Element Tables).
- 7.1.8 <u>NDFD Graphic Mosaic Access</u>. NDFD graphic mosaic images can be viewed by clicking the active web link below:

**View NDFD Graphic Mosaics** 

- 8. Interactive Web-based Services.
- 8.1 <u>National Web-based Services</u>. National web-based services should meet national customer requirements for digital services which are widespread (multi-regional or national) in

scope or coverage. Services should be timely, accurate, and consistent (meteorologically, functionally, and aesthetically) with other NWS web-based digital services.

- 8.2 <u>Regional Web-based Services</u>. Regional web-based services should meet customer requirements for digital services covering multi-state, or multi-WFO geographic areas of responsibility. Services should be timely, accurate, and consistent (meteorologically, functionally, and aesthetically) with NWS national web-based digital services.
- 8.2.1 <u>Multi-Format Forecast Information Web Page</u>. This service is an interactive forecast information web page allowing users to access forecast information that is always current with higher resolution than is possible in traditional text forecast products (which may be averaged over time and space). Customers can view forecast information retrieved directly from locally prepared forecast grids in a variety of formats, including icons, text, tabular and graphic. Data fields include, surface temperature, dewpoint, wind speed and direction, weather, sky cover, and probability of precipitation.
- 8.2.2 <u>Purpose</u>. Advances in computer capabilities and web services technologies, as well as scientific advances in National Weather Service (NWS) software, have prompted the NWS to create customer-based web services. Information dissemination via the world wide web (www) allows customers to obtain higher resolution forecast information in a variety of formats ondemand.
- 8.2.3 <u>Audience</u>. The current audience for the forecast information web page consists of the general public and partners such as emergency managers, other government agencies, universities, media, and private companies.
- 8.2.4 <u>Availability and Timeliness</u>. Data are extracted from WFO digital databases on a routine basis, then processed and sent to NWS regional web servers. Updates to grid point forecasts are made as often as necessary and posted once an hour from the local office digital database. These updates are available at quarter past every hour.
- 8.2.5 <u>Presentation Format</u>. The web grid point forecasts are presented for display as HyperText Markup Language (HTML) in text, hourly meteogram, and digital/tabular format. The forecasts can be viewed using a web browser, and then selected on a map location or by entering specified latitude and longitude coordinates.
- 8.2.6 <u>Spatial Resolution</u>. Digital data are available at a spatial resolutions of 5 km.
- 8.2.7 <u>Temporal Resolution</u>. Temporal resolutions vary depending upon forecast type. Text forecasts are available out to 7 days; meteograms to 48 hours; digital/tabular forecasts to 120 hours.

- 8.2.8 <u>Multi-Format Forecast Web Page Access</u>. The multi-format forecasts are available on many WFO web pages in Central, Southern and Eastern regions. Access to these forecast offices' web pages can be made by navigating from the National Weather Service web page: <a href="www.weather.gov">www.weather.gov</a> and from the regional web sites. The forecasts can be viewed using a web browser, and then selected on a map location or by entering specified latitude and longitude coordinates. A real-time example of this web page can be found by clicking on the following active web link: Multi-Format Forecast Web Page
- 8.3 <u>Local Web-based Services</u>. Local web-based services created by individual WFOs should be designed to meet local customer requirements for digital weather information in multiple forms (e.g, text, graphics, interactive services). Products and services should be timely, accurate, and consistent (meteorologically, functionally, and aesthetically) with NWS national and regional web-based products/services.

#### Appendix A - NDFD Weather Elements

NDFD weather elements should be continuous in time and space:

- All forecasts are valid at individual grid points, and are used to represent the surrounding grid space defined by the resolution of NDFD. Any necessary basin or zone averaging will be performed by product generation software. Therefore, except where zone boundaries naturally correlate to weather features, zone product boundaries should not be evident in the underlying forecast grids.
- All forecasts are valid at the top of the specified hour and represent the next 59 minutes.
- Local forecast grids should have full coverage in time so that grids can be sampled at any hour. At extended forecast ranges, time periods may be stretched over multiple hours from which snapshot values for any hour could be taken. Time interpolation tools may also be used for this purpose.
- The distribution of forecast values for any NDFD element should be continuous. It is not desirable to categorize (or round) forecasts on grids according to that element's use in NWS text products (e.g., PoPs by values of 10). If forecasts are categorized, it makes intersite coordination, forecast mosaicing, and the use of many smart tools more difficult.
- High resolution terrain effects should be included in all grids (e.g., temperatures that reflect lapse rates).
- Collaboration thresholds are only valid for grid points within 1000 feet elevation of each other.
- Grid points that lie on opposite sides of coastal boundaries (i.e., land/water) are excluded from collaboration threshold requirements.

The following list contains the definitions, **minimum** requirements for NDFD grid production, and collaboration thresholds for the primary Public, Marine, and Fire Weather elements produced at NWS Weather Forecast Offices in the conterminous United States. **However, many grids** should be <u>populated in the local database at each hour</u> to support both UTC sampling intervals for NDFD and Local Time (LT) sampling intervals for local products.

#### A. General Weather Elements.

**Max/Min Temp** - the maximum daytime temperature or minimum overnight temperature in degrees Fahrenheit (°F). Verifying observations are deduced via a comprehensive algorithm that

examines reported max/min and hourly temperatures. Daytime is defined as **0700-1900 Local Standard Time**, and overnight as **1900-0800 Local Standard Time**. The 1 hour overlap was introduced by the NWS in the mid-1980s to include mins that occur just after sunrise.

- Grid Production Requirement: A Maximum Temperature grid and a Minimum Temperature grid will be produced for each 24-hour period out to 168 hours from 00 UTC Day 1.
- *Collaboration Threshold:* 5 deg (7 deg in complex terrain complex terrain, <u>i.e.</u>, <u>greater</u> than 500 ft. differences in elevation between adjacent grid points).

**Temperature** - the expected temperature in °F valid for the indicated hour.

- *Grid Production Requirement:* Temperature grids will be produced at a minimum every 3 hours out to 72 hours, then every 6 hours out to 168 hours from 00 UTC Day 1.
- *Collaboration Threshold:* 5 deg (7 deg in complex terrain).

**Dewpoint** - the expected dew point temperature in °F valid for the indicated hour.

• Grid Production Requirement: Dewpoint grids will be produced at a minimum every 3 hours out to 72 hours, then every 6 hours out to 168 hours from 00 UTC Day 1. Collaboration Threshold: 5 deg (7 deg in complex terrain).

**Relative Humidity** - derived from the associated Temperature and Dewpoint grids for the indicated hour.

- Grid Production Requirement: Relative Humidity grids will be produced at a minimum every 3 hours out to 72 hours from 00 UTC Day 1.
- Collaboration Threshold: N/A.

**Apparent Temperature** - the perceived temperature derived from either a combination of temperature and wind (Wind Chill), or temperature and humidity (Heat Index) for the indicated hour. Apparent temperature grids will signify the Wind Chill when temperatures fall to 50 °F or less, and the Heat Index when temperatures rise above 80 °F. Between 51 and 80 °F the Apparent Temperature grids will be populated by the ambient air temperature.

- Grid Production Requirement: Apparent temperature grids are routinely produced year round at a minimum of every 3 hours out to 72 hours from 00 UTC Day 1.
- Collaboration Threshold: N/A.

**12-hour Probability of Precipitation** (PoP12) - the likelihood, expressed as a percent, of a measurable precipitation event (1/100th of an inch) at a grid point during the valid period. The 12-hour periods in NDFD begin and end at 0000 and 1200 UTC. PoP12 should be derived from floating PoP12 values.

- Grid Production Requirement: PoP 12 grids will be produced at a minimum each 12-hour period out to 168 hours from 00 UTC Day 1.
- Collaboration Threshold: 20%.

Floating PoP12 - an internal NWS index from which a PoP12 for any 12-hour period can be derived by taking the maximum floating PoP12 value within the desired period. A floating PoP12 should be considered as that hour's contribution to the PoP12, not as a 1 hour PoP, which has different statistical characteristics. Floating PoP12 values are best stretched over time ranges consistent with other precipitation related elements--ultimately resulting in complete coverage at every hour. Floating Pop12 grids support the generation of PoP12s in both UTC and LT.

- Grid Production Requirement: Floating PoP12 grids will be produced at a minimum every hour out to 168 hours from 00 UTC Day 1.
- Collaboration Threshold: N/A.

**Sky Cover** - the expected amount of opaque clouds (in percent) covering the sky valid for the indicated hour.

- Grid Production Requirement: Sky Cover will be produced at a minimum every 3 hours through 72 hours, then every 6 hours out to 168 hours from 00 UTC Day 1.
- *Collaboration Threshold:* 30% (40% in complex terrain).

**Wind Direction** - the expected 10 meter wind direction using 36 points of a compass valid for the indicated hour. **Wind Speed** is the expected sustained 10 meter wind speed (in knots) valid for the indicated hour. Refer to NWSI 10-601, Tropical Cyclone Weather Services Program, Section 9, for procedures to populate WFO-generated wind forecasts grids for tropical cyclones.

- Grid Production Requirement: Wind Direction and Wind Speed grids will be produced at a minimum every 3 hours through 72 hours, then every 6 hours out to 120 hours from 00 UTC Day 1.
- Collaboration Threshold (Wind Direction): 90 degrees.
- *Collaboration Threshold (Wind Speed):* 10 kts (15 kts in complex terrain).

**Wind Gust** - the combination of the expected 10 meter wind sustained speed (*in knots*) and the gusts valid for the indicated hour. If gusts are not forecast, those grid points will be populated with "zeroes." Speeds are converted to mph, as appropriate, by product generation software.

- Grid Production Requirement: Wind Gust grids will be produced on a routine basis at a minimum of every 3 hours out to 72 hours from 00 UTC Day 1.
- Collaboration Threshold: None.

Weather - the expected weather (precipitating or non-precipitating) valid for the indicated hour. *Precipitating Weather* includes type, probability or coverage, and intensity information for precipitation (e.g., rain, ice, snow). Precipitating weather should have a non-null value at any grid point with a corresponding floating PoP12 value of at least 15 percent. *Non-precipitating Weather* includes obstructions to visibility (e.g., fog, haze, smoke) elements. Fog should have a non-null value at any grid point when obstructions are forecast to reduce visibility to 5 nautical (6 statute) miles or less. Dense fog should be included when visibility is reduced to 1 nautical mile or less (over water) and 1/4 statute mile or less (over land). Apply coverage terms (i.e., widespread, areas of, patchy) in accordance with definitions in NWSI 10-503, WFO Public Weather Forecast Products Specification.

- Grid Production Requirement: Weather Grids will be produced at a minimum every hour (as necessary) out to 168 hours from 00 UTC Day 1.
- *Collaboration Threshold:* N/A (discrete element).

**Quantitative Precipitation Forecast (QPF)** - the total amount of expected liquid precipitation (in hundredths of inches). A QPF will be specified when a measurable precipitation type is forecast for any hour during a QPF valid period. Valid periods for the NDFD begin and end at 0600, 1200, 1800, and 0000 UTC.

- Grid Production Requirement: QPF grids will be produced at a minimum for each 6 hour period out to 72 hours from 00 UTC Day 1.
- Collaboration Threshold: 0.25 in/6 hr.

**Snow Accumulation** - the expected total accumulation of new snow (in inches). Snow accumulation will be specified when a measurable snowfall is forecast for any hour during a valid period. Valid periods for the NDFD begin and end at 0600, 1200, 1800, and 0000 UTC.

- *Grid Production Requirement:* Snow Accumulation grids will be produced for each 6 hour period out to 48 hours from 00 UTC Day 1.
- *Collaboration Threshold:* 2 inches/ 6 hr.

#### B. <u>Fire Weather Elements</u>.

Min/Max Relative Humidity - the daytime minimum and the nighttime maximum relative humidity for the same valid times used for Max/Min temperature.

- *Grid Production Requirement:* None (experimental grid).
- Collaboration Threshold: N/A (derived element).

**LAL (Lightning Activity Level)** - a measurement of the cloud-to-ground lightning activity observed (or forecast to occur) within a 30-mile radius of a grid point. LAL is expressed as discrete element categories with values from 1 to 6 (see Table 2). Value is the max during the 6 hour valid period.

- *Grid Production Requirement:* None (experimental grid).
- *Collaboration Threshold:* 2 (except for valid discrepancies between wet and dry thunderstorms).

LAL	Storm Development	Coverage
1	No thunderstorms	
2	Isolated thunderstorms	1-14%
3	Widely scattered thunderstorms	15-24%
4	Scattered thunderstorms	25-54%

5	Numerous thunderstorms	> 54%
6	Same as #3, but dry thunderstorms	

Table 2. Lightning Activity Level (LAL) Categories.

**20 ft. Wind** - the expected 20 foot, 10 minute average wind speed (*in knots*) derived from the wind speed grid and valid for the indicated hour.

- Grid Production Requirement: 20 ft. Wind is produced at a minimum every 3 hours out to 48 hours from 00 UTC Day 1.
- *Collaboration Threshold:* N/A (derived element).

#### C. Marine Elements.

**Significant Wave Height** - the average height (trough to crest) of the one-third highest waves. valid for the indicated 12 hour period.

- Grid Production Requirement: Significant Wave Height will be produced at a minimum every 12 hours out to 120 hours from 00 UTC Day 1.
- Collaboration Thresholds:
  - a. For wave heights forecast to be 6 feet or less, a threshold of 2 feet.
  - b. For wave heights forecast to be greater than 6 ft, a threshold of 25% of the forecast significant wave height.

**Visibility** - the maximum number of nautical miles an object can be seen and identified in the horizontal. The maximum distance is determined for a minimum area of one half of the horizon circle. Visibility greater than six nautical miles is unrestricted.

- *Grid Production Requirement:* None (experimental grid).
- Collaboration Threshold: 3 nautical miles.

Appendix B - Grids Required for the Production of 10 NWS IOC products.

GRIDS	ZFP	CCF	SAF	SFT	FWF	FWM	CWF	GLF	NSH	MVF
max/min temp	X	X	X	X	X	X				
temperature	X		X		X	X				
dewpoint	X		X							
relative humidity*						X				
max/min RH *					X					
heat index*	X		X							
wind chill*	X		X							
floating PoP12	X				X	X				
prob of precip. (12h)*	X	X	X	X	X					
sky cover	X	X	X	X	X	X			X	
wind direction and speed	X		X		X	X	X	X	X	X
wind gusts (>10 kts over sustained)	X		X		X					
20 ft. wind * (NWS regional option)					X					
Lightning Activity Level (LAL)						X				
weather (type, intnsty, prob/covrg)	X	X	X	X	X	X	X	X	X	
snow amount	X		X							
significant wave height							X	X	X	X
visibility							X	X	X	
* Indicates a derived	element									

**Table 3.** WFO Local Grid Elements Necessary to Produce the 10 NWS base products for IOC.

### Appendix C - NDFD Weather Element Tables

The following tables show forecast projection times at which samples for the NDFD are taken. These projection times equate to the minimum grid production requirements for the NDFD. All tables begin at 00 UTC, Day 1 and extend out to a maximum of 168 hours. For some fields, this is a *subset* of the hourly grid requirement needed in the local database for the production of the local text products (requiring local time). Derived fields are indicated by the "\*" symbol.

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<b>General Weather Element</b>	Gr	id	A۱	ail	ab	ilit	y							r	Tir	me	Pr	oje	ecti	ion	s f	roı	n (	0 1	UT	C,	Da	ıy	1 =		>	_								
Diurnal Day (CONUS)	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7
UTC Day	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8
UTC Hour	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	06	12	18	00	06	12	18	00	06	12	18	00	06	12	18	00
Hours	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	78	84	90	96		108		120		132		144	L	156		16
max/min temperature			,	Α		-	-	A				A				Α				A				A		A		A		A		A		A		A		A		A
temperature	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
dewpoint	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
apparent temperature*	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A																
relative humidity*	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A																
probability of precip. (12h)*				A		•		A				A				A				A				A		A		A		A		A		A		A		A		A
sky cover	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
wind direction and speed	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
wind gust	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A																
weather (type, intnsty,prob/cvrg)	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
quantitative precipitation		A		A		A		A		A		A		A		A		A		A		A		A																
snow amount		A		A		Δ		A		A		A		A		A																								

A - Required minimum threshold for NDFD

X - Proposed for experimental dissemination

<sup>\*</sup> derived field



### Fire Weather Element Grid Availability

## Time Projections from 00 UTC, Day 1

Diurnal Day (CONUS)	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7
UTC Day	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8
UTC Hour	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	06	12	18	00	06	12	18	00	06	12	18	00	06	12	18	00
Hours	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	78	84	90	96		108		120		132	:	144		156		168
max/min relative humidity*				X				X				X				X																								
20 ft wind*	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A																								
lightning activity level		X		X		X		X		X		X		X		X																								

A - Required minimum threshold for NDFD IOC

X - Proposed for experimental dissemination

<sup>\*</sup> derived field

**Marine Element Grid Availability** 

Time Projections from 00 UTC, Day 1



Marine Element Olla Hvan	W N III U	<i>J</i>															J) C		0110		011		•		$\sim$		J -												
Diurnal Day (CONUS)	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7 7
UTC Day	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7 8
UTC Hour	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	06	12	18	00	06	12	18	00	06	12	18	00	06	12	18 00
Hours	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	78	84	90	96		108		120		132		144		156	16
wave height (significant)				A				A				A				A				A				A		A		A		A		A							
visibility	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																							

A - Minimum threshold for NDFD IOC

X - Proposed for experimental dissemination

<sup>\*</sup> derived field

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# Appendix D - Glossary of Terms

BUFR	<u>Binary Universal Form for the Representation of meteorological data – World Meteorological Organization standard binary code designed to represent any meteorological data.</u>
Digital Data	Numerical or other information represented in a form suitable for processing by computer.
Digital Forecast	A forecast represented by digital datanot words, phrases, or sentences.
Digital Forecast Database	A database containing digital forecasts
Digital Forecast Product	A formatted, usually graphical, representation of digital forecasts.
Forecast Element	A component of a weather forecast (e.g., temperature, wind, cloud).
Forecast Collaboration	The act of 2 or more forecasters working together through a process to reach a consensus on hydrometeorological forecast information.
Forecast Coordination	The exchange of hydrometeorological forecast information
Forecast Mosaic	A composite of gridded forecasts
Graphical Forecast Editor (GFE)	A graphical user interface that allows forecasters to modify gridded forecast fields using a variety of tools.

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GRIB	GRIdded Binary, World Meteorological Organization standard binary code to represent gridded data.
Gridded Forecast	Forecasts at regularly spaced points on a surface
Interactive Forecast Preparation (IFP)	Concept where a forecaster edits, or interacts with, forecast elements in a digital database from which user products are generated
Interactive Forecast Preparation System (IFPS)	An interactive computer system that assists in the development of digital forecasts.
IFPS Initial Operating Capability (IOC)	The condition in which all WFOs are able to produce the grids necessary to automatically compose ten base NWS text products and will produce those products with software (formatters).
Intersite Coordination (ISC)	A technique employed within IFPS to exchange digital forecast grids from each WFO to other WFOs for the express purpose of coordinating the forecasts.
National Digital Forecast Database (NDFD)	A composite of official and experimental NWS digital forecasts (as distinct from guidance). It will house these forecast grids from all operational elements of the NWS